

Application Serial No. 10/583,880
Reply to Office Action of April 13, 2010

PATENT
Docket: CU-4890 RECEIVED
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REMARKS

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In the Office Action, dated April 13, 2010, the Examiner states that Claims 40-56 are pending and rejected. By the present Amendment, Applicant cancels the claims without prejudice or disclaimer of the subject matter thereof and adds new Claims 57-74.

Rejections under 35 U.S.C. §103(a)

Claims 46 and 48-50 are rejected under 35 U.S.C. §103(a) as being unpatentable over Oe et al. (JP 2000-109510). Claims 46 and 48-50 are rejected under 35 U.S.C. §103(a) as being unpatentable over Keys et al. '102, as evidenced by Monroe '790. Claims 46 and 48-50 are rejected under 35 U.S.C. §103(a) as being unpatentable over Keys in view of Monroe and Baum et al. '275. Claims 46-50 are rejected under 35 U.S.C. §103(a) as being unpatentable over Keys in view of Monroe, Baum and Asakawa et al. '598. Claims 40 and 42-45 are rejected under 35 U.S.C. §103(a) as being unpatentable over Laganis et al. (EP 0 437 259). Claims 40-45 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kawabata et al. '340 in view of Harada et al. JP 01-287105. Claims 51-56 are rejected under 35 U.S.C. §103(a) as being unpatentable over Okubo et al. '324 in view of Ernst et al. DE 100571141 and Yamaguchi et al. JP 06-175554. Applicant respectfully disagrees with and traverses these rejections.

Applicant indicates that independent Claims 57, 63 and 69 have been added to the present application, and dependent claims have been added which depend therefrom. Independent Claim 57 corresponds to cancelled Claim 40 and relates to the recording method which is applied to the red recording wavelength in the range from 630 to 670 nm and is characterized in that the sensitizing dye is selected from the compounds (1) and (2).

New Claim 63 corresponds to cancelled Claim 46 but is slightly modified in that it does not recite the feature of the second refractive index modulation component. In regard to the second refractive index modulation component, new claim 11 deals with this feature. Claim 63 relates to the recording method which is applied to the green recording wavelength in the range from 514 to 560 nm and is characterized in that the sensitizing dye is selected from the compounds (3) and (4).

New Claim 69 corresponds to cancelled Claim 51 and recites the recording

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method which is applied to the blue recording wavelength in the range from 420 to 488 nm and is characterized in that the sensitizing dye is selected from the compounds (5) and (6).

The new independent claims are limited to the method of producing a volume hologram comprising "the step of providing an original plate of hologram on a back surface of the hologram recording portion and performing interference exposure by applying a reference light from the front side of the hologram recording portion." Such a recording method may be "the on axis method." For example, this method is described on page 11, line 36 of Laganis et al. (EP437259).

The basis for "the on axis method" is as follows.

On page 41, lines 9 to 16, of the specification of the present invention, it is described that "for example, if required, after preliminarily polymerizing the photopolymerizable compound by radiating the hologram recording material layer of the photosensitive medium for volume hologram recording with relatively weak uniform light, an original plate of hologram is faced to adhere, and then, interference exposure is performed from the transparent substrate film side using a recording light in a visible region, thereby a volume hologram is formed."

The on axis method is also supported by the use of a mirror in Example 1 (page 47, line 13 of the specification) and Examples 2 to 6 (page 47 to 51), which is a specific example of the original plate of hologram.

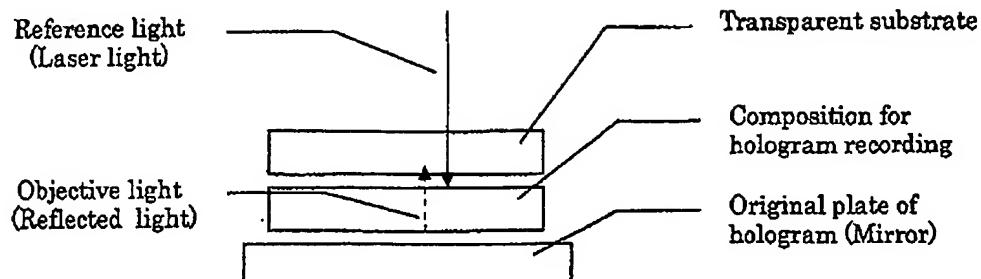
In the presently claimed invention, an original plate of hologram is provided on the back surface of the hologram recording portion and interference exposure is performed by applying a reference light from the front side of the hologram recording portion, and the presently claimed invention is now characterized by employing such a method as the method of recording a hologram.

The following figure shows an arrangement that was employed in the hologram recording method employed in the Examples of the present application:

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[FIG. 1]



The characteristics of the presently claimed invention will be described in reference to the above figure. The hologram recording portion is provided on the transparent substrate and the original plate of hologram is provided on the other surface of the portion. When reference light (krypton laser light in Example 1) is applied to the members arranged as above from the transparent substrate side, the light is reflected by the original plate to generate objective light. Consequently, the reference light and objective light cause interference and as a result, a refractive index modulation corresponding to an interface fringe produced by the interference occurs inside the hologram recording portion, thereby recording a volume hologram.

If the maximum absorption wavelength of the sensitizing dye contained in the hologram recording portion is close to the recording wavelength, the reference light is mostly absorbed by the hologram recording portion, so that the amount of light which reaches the original plate is decreased. Therefore, the interference produced by the reference light and objective light cannot be produced efficiently.

Consequently, as set forth in Claim 57 of the present invention, when "the sensitizing dye has absorption at a volume hologram recording wavelength and the maximum absorption wavelength of the dye deviates by 14 nm or more from the volume hologram recording wavelength," the above problem does not occur and a brighter volume hologram can be recorded.

With respect to new Claim 57, the following references have been raised and discussed by the Examiner (see Item 8 and 9 in the final Office Action):

Laganis et al. (EP437259)

Kawabata et al. ('340)

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Harada et al. (JP01-287105)

In these references, however, the sensitizing dye selected from the compounds (1) and (2) in Claim 57 is not taught or suggested. That is, Laganis et al. (EP437259) teaches that squarylium dye 3 was used in Examples 5 (see Table 1) and Example 12 (Table 2). However, the structure of squarylium dye 3 (sensitizer 3) is different from that of the compound (2) used in Claim 57. Kawabata et al. ('340) teaches that DYE-4 was used in Example 24. However, the structure of DYE-4 is different from that of the compound (1) used in Claim 57. Harada et al. (JP01-287105) teaches that a cyanine dye is incorporated in a photopolymerizable compound. However, the structure of the cyanine dye is different from that of the compound (1) used in Claim 57.

In addition, these references fail to teach or suggest how much the recording wavelength applied to the interference exposure deviates from the maximum absorption wavelength of the used sensitizing dye.

Of the cited references, Laganis et al. (EP437259) described that a volume hologram is recorded by the on axis method. From the description only, however, it is very difficult to conceive that allowing the recording wavelength to deviate from the maximum absorption wavelength of the sensitizing dye by 14 nm or more in the red region, is preferable when recording a volume hologram by the on axis method.

In the case of recording a volume hologram by the on axis method, it is necessary to consider not only the sensitivity of the sensitizing dye but also the intensity of the objective light reflected by the original plate of hologram.

Considering, when recording a volume hologram, efficiently sensitizing the sensitizing dye in the hologram recording portion, it is a commonly-acceptable method for those skilled in the art to make the recording wavelength consistent with the maximum absorption wavelength of the sensitizing dye, ideally. In the case where they are not absolutely consistent with each other due to a restriction derived from, for example, performances of the laser device used, it is a commonly-acceptable method to make the recording wavelength and the maximum absorption wavelength consistent with each other as much as possible. Accordingly, it is not a commonly-performed method to allow the recording wavelength to, as described in the present invention, deviate from the maximum absorption wavelength of the sensitizing dye by 14 nm or more.

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In the new claims, however, the presently claimed invention is now beyond the common sense of those skilled in the art who focus on the sensitivity dye only. It has been achieved on the basis of the idea that when the original plate of hologram is provided on the back surface of the hologram recording portion and the reference light is applied from the front side of such an arrangement, good sensitivity of the sensitizing dye to the entered reference light is not enough and the intensity of the objective light reflected by the original plate has to be large to be beneficial to increase the diffraction efficiency.

When the original plate of hologram is provided on the back surface of the hologram recording portion and the reference light is applied from the front side of such an arrangement, those skilled in the art would not easily conceive that the recording wavelength is allowed to deviate from the maximum absorption wavelength of the sensitizing dye from 14 nm or more.

To support a *prima facie* case of obviousness, the Office Action must establish "a finding that the prior art included each element claimed, although not necessarily in a single prior art reference, with the only difference between the claimed invention and the prior art being the lack of actual combination of the elements in a single prior art reference." Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in view of *KSR International Co. v. Teleflex Inc.*, 72 Fed. Reg. 57,526 (Oct. 10, 2007). Since the prior art does not teach or suggest each and every feature of new independent Claim 57, Applicant respectfully asserts that a *prima facie* case of obviousness cannot presently be established.

Claim 63 relates to the recording method which is applied to the green recording wavelength (514 to 560 nm) and is characterized in that the sensitizing dye is selected from the compounds (3) and (4); a volume hologram is recorded by the on axis method; and in the green region, the recording wavelength deviates from the maximum absorption wavelength of the sensitizing dye from 14 nm or more.

The following references have been raised and discussed by the Examiner in connection with new Claim 63 (see Items 5, 6 and 7 in the final Office Action):

Oe et al. (JP2000-109510)
Keys et al. ('102)
Monroe ('790)

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Baum et al ('275)
Akasaka et al, ('598)

Oe et al. teaches that a cyclopentanone compound is used as a hologram recording material (see paragraph [0026]). Also, compound "D-3" used in Example 3 (Table 1 in paragraph [0037]) and Example 11 (Table 2 in paragraph [0040]) of Oe et al. is a cyclopentanone compound. In Oe et al., the recording wavelength used in Example 3 is 514.5 nm (paragraph [0045]).

Keys et al. ('102) discloses Examples in which a cyclopentanone compound "DEAW" is used as the sensitizing agent for producing a volume hologram (see column 17, lines 55 and 56).

Baum et al ('275) is mentioned in column 8, line 68 of Keys et al. In Baum et al., a cyclopentanone compound is mentioned as an example.

In Monroe ('790), the maximum absorption wavelength and extinction coefficient of "DEAW" are mentioned, as well as those of a cyclopentanone compound "JAW".

In Akasaka et al. ('598), it is mentioned that a cyclopentanone compound and a diphenyliodonium compound are combined and used as a hologram recording material (see column 19).

As described above, pieces of fragmentary information that may somewhat relate to the presently claimed invention are mentioned in the references. However, in any of the cited references, there is no teaching or suggestion that connects the pieces of information together and Applicant respectfully asserts that such piecing of the information could only occur through impermissible hindsight reasoning in an attempt to reconstruct the presently claimed invention.

As explained above, Oe et al. (JP2000-109510) mentioned the sensitizing dye for green recording wavelength of the present invention (compound (3)) and also mentioned in Examples that a visible light having a wavelength of 514.5 nm was applied to a coating film. In Oe et al., however, the maximum absorption wavelength of the dye (compound (3)) is not taught or suggested and there is no teaching or suggestion that the on axis method is employed in the field of volume hologram. Also in the above Examples of Oe et al., the exposure of a simple coating film to the light with a wavelength of 514.5 nm is only mentioned and no hologram was produced.

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Also, Keys et al. ('102) and Monroe ('790) mentioned the sensitizing dye for green recording wavelength of the present invention (compound (3)) and also mentioned that a volume hologram is produced by the on axis method. No example is described in these references, however, in which the on axis method is conducted by using the dye (compound (3)). Also, the maximum absorption wavelength of the dye for green recording wavelength and the recording wavelength are not taught or suggested in any of the references.

From the pieces of fragmentary information only, however, Applicant respectfully asserts that it is very difficult to conceive that allowing the recording wavelength to deviate from the maximum absorption wavelength of the sensitizing dye by 14 nm or more in the green region, is preferable when recording a volume hologram by the on axis method.

In view of the foregoing, Applicant respectfully asserts that new Claim 63 should not be considered obvious over the cited prior art.

Independent Claim 69 relates to the recording method which is applied to the blue recording wavelength (420 to 488 nm) and is characterized in that the sensitizing dye is selected from the compounds (5) and (6); a volume hologram is recorded by the on axis method; and in the blue region, the recording wavelength deviates from the maximum absorption wavelength of the sensitizing dye from 14 nm or more.

The following references have been raised and discussed by the Examiner in connection with new Claim 69 (see Items 13 and 14 in the final Office Action):

Okubo et al. ('324)
Ernst et al. (DE 100571141)
Yamaguchi et al. (JP06-17554)

In these references, however, the sensitizing dye which is selected from the compounds (5) and (6) in Claim 69 is not taught or suggested. That is, Okubo et al. ('324) mentioned that dye D-22 was used in Example 21. However, the structure of the compounds (5) and (6) is different from that of dye D-22 (see column 9, around line 25) or those of other dyes. Ernst et al. (DE 100571141) mentioned Formula A (see the top of page 3). The structure of Formula A does not anticipate compound (5) and (6). Also, in Yamaguchi et al. (JP06-175554), the compounds (5) and (6) recited in Claim 69 are not taught or suggested.

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In addition, it is not mentioned in any of the references how much the recording wavelength applied to the interference exposure deviates from the maximum absorption wavelength of the used sensitizing dye.

Furthermore, the references fail to teach or suggest that a volume hologram is recorded by the on axis method.

From these descriptions only it is very difficult to conceive that allowing the recording wavelength to deviate from the maximum absorption wavelength of the sensitizing dye by 14 nm or more in the blue region, is preferable when recording a volume hologram by the on axis method.

Regardless, Applicant respectfully asserts that none of these references, taken alone or in combination, teach or suggest each and every feature of new Claim 69 and, therefore, a *prima facie* case of obviousness cannot be established.

Since the independent claims are allowable over the prior art, Applicant asserts that all claims depending therefrom are allowable for at least the same reasons, as well as for the features that they recite. As such, Applicant respectfully requests withdrawal of the present rejections under 35 U.S.C. §103(a).

In light of the foregoing response, all the outstanding objections and rejections are considered overcome. Applicant respectfully submits that this application should now be in condition for allowance and respectfully requests favorable consideration.

Respectfully submitted,



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